

Claims:

1. A magnetoresistant enameled wire comprising a conductive core wire and a coating material coated onto the outer surface of the core wire, wherein the coating material is a magnetoresistant material.
2. The enameled wire according to claim 1, wherein the magnetoresistant material is an anisotropic material.
3. The enameled wire according to claim 1, wherein the enameled wire comprises:
 - a) a conductive core wire; and
 - b) at least one varnish layer containing a magnetoresistant material, the varnish layer is positioned at the outer surface of the core wire of a).
4. The enameled wire according to claim 3, wherein the varnish layer is an insulating varnish layer or a self-bonding insulating varnish layer.
5. The enameled wire according to claim 1, wherein the magnetoresistant material is at least one material selected from the group consisting of ferromagnetic materials including:
 - i) high magnetic permeability magnetically soft alloys containing at least one metal selected from rare earth metals and transition metals;
 - ii) high magnetic permeability magnetically soft composite oxides containing at least one metal selected from rare earth metals and transition metals; and
 - iii) high magnetic permeability magnetically soft composite nitrides containing at least one metal selected from rare earth metals and transition metals.

6. The enameled wire according to claim 1, wherein the magnetoresistant material is at least one material selected from the group consisting of high permeability magnetically soft materials including pure iron, Sendust, silicon steel, Permalloys and
5 amorphous alloys.

7. The enameled wire according to claim 1, wherein the magnetoresistant material is at least one material selected from the group consisting of high permeability magnetically soft materials including 45 Permalloy, 78 Permalloy, 81 Permalloy, Mo
10 Permalloy, Cr Permalloy, Cu Permalloy, Si Permalloy, Ti Permalloy, Mu metal, Co amorphous alloy, Fe amorphous alloy and Ni-Fe amorphous alloy (including at least one element selected from Mn, Cr, Co, Nb, V, Mo, Ta, W and Zr).

8. The enameled wire according to claim 1, wherein the magnetoresistant
15 material is at least one material selected from the group consisting of high permeability magnetically soft materials including:

- (1) Ni-Fe-Mo-based 4% Permalloys,
- (2) Ni-Cu-Zn-based magnetically soft ferrites,
- (3) Mn-Zn-based magnetically soft ferrites containing Fe_2O_3 , MnO, ZnO as main
20 components and NiO, MgO, CuO, SiO_2 , CaO, V_2O_5 , TiO_2 , Nb_2O_5 , etc., as property-improving additives,
- (4) Ni-Zn-based magnetically soft ferrites,
- (5) Mg-Mn-Zn-based magnetically soft ferrites,
- (6) Mg-Cu-Zn-based magnetically soft ferrites,
- (7) Fe-Ti-N-based magnetically soft ferrites,
25 (8) Fe-Cr-based magnetically soft ferrites (minor components: C, N, Si, Mn, Ni, P, S, Cr, Al, Mo and Ti),

- (9) Fe-Co-Ni-N-based magnetically soft ferrites,
- (10) Fe-Co-based magnetically soft ferrites,
- (11) Fe-Al-Si-based magnetically soft alloy powders,
- (12) Fe-Al-based magnetically soft alloy powders,
- 5 (13) Fe-Si-B-Cu-Nb-based magnetically soft alloy powders,
- (14) Fe-Br-B-Cu-based magnetically soft alloy powders,
- (15) Fe-B-M-N-R-based magnetically soft alloy powders (wherein M is an element selected from Hf, Zr and Nb, N is Cu element, R is at least one element selected from Ti, V, Ta, Cr, Mn, Mo, W, Au, Ag, Zn, Ga and Ge),
- 10 (16) Fe-based magnetically soft alloy powders $((\text{Fe}_{1-x}\text{M}_x)_{100-a-b-c-d}\text{Si}_a\text{Al}_b\text{B}_c\text{K}_d)$ (wherein M is Co, Ni or a mixture thereof, K is at least one element selected from Nb, Mo, Zr, W, Ta, Hf, Ti, V, Cr, Mn, Y, Pd, Ru, Ge, C and P),
- (17) Fe-based magnetically soft alloy powders (Fe is a base, either Co or Ni, and an additive is at least one element selected from the group consisting of Ti, Zr, Hf, V,
- 15 Nb, Ta, Mo and W),
- (18) Fe-Zr-B-Ag-based magnetically soft alloy powders,
- (19) Fe-Hf-based magnetically soft alloy powders,
- (20) Fe-Si-based, Fe-Si-Al-based, Fe-Ni-based magnetically soft alloy powders,
- (21) magnetically soft alloy powders composed of Fe-(at least one element
- 20 selected from Ta, Hf, Zr, Nb, Mo, Al, Si, Ti, Cr and W)-(at least one element selected from C, N, O and B)-P,
- (22) magnetically soft powders having a composition consisting of iron oxide (Fe_2O_3), nickel oxide (NiO), zinc oxide (ZnO), copper oxide (CuO) and bismuth oxide (Bi_2O_3),
- 25 (23) magnetically soft powders having a composition consisting of Fe-Co-(at least one element selected from Sm, Er, Tm, Yb and Ho as rare earth metals)-(at least one element selected from C, N, O and B, elements for microcrystallization),

(24) Mg-Zn-based, Mn-Al-based, Co-Pt-based, Cu-Ni-Co-based, Cu-Zn-based, Mn-based, Co-based, Li-based, Mg-based, Ni-based magnetically soft ferrite powders; and

(25) magnetically soft composite oxides containing one or more compounds
5 selected from Fe_2O_3 , Fe_3O_4 and CoFe_2O_4 as main components.

9. The enameled wire according to claim 3, wherein the magnetoresistant material is present in an amount of 0.3~30% by weight in the varnish layer.

10 10. A method for manufacturing a magnetoresistant enameled wire, comprising:
a) providing a conductive core wire; and
b) coating a varnish containing a magnetoresistant material on the outer surface
of the conductive core wire and softening.

15 11. The method for manufacturing a magnetoresistant enameled wire according to claim 10, wherein the varnish layer is an insulating varnish layer or a self-bonding insulating varnish layer.

12. The method for manufacturing a magnetoresistant enameled wire according
20 to claim 10, wherein the magnetoresistant material is at least one material selected from the group consisting of ferromagnetic materials including:

i) high magnetic permeability magnetically soft alloys containing at least one metal selected from rare earth metals and transition metals;

ii) high magnetic permeability magnetically soft composite oxides containing at
25 least one metal selected from rare earth metals and transition metals; and

iii) high magnetic permeability magnetically soft composite nitrides containing at least one metal selected from rare earth metals and transition metals.

13. The method for manufacturing a magnetoresistant enameled wire according to claim 10, wherein the magnetoresistant material is at least one material selected from the group consisting of high permeability magnetically soft materials including pure iron, Sendust, silicon steel, Permalloys and amorphous alloys.

14. The method for manufacturing a magnetoresistant enameled wire according to claim 10, wherein the magnetoresistant material is at least one material selected from the group consisting of high permeability magnetically soft materials including Permalloy, 78 Permalloy, 81 Permalloy, Mo Permalloy, Cr Permalloy, Cu Permalloy, Si Permalloy, Ti Permalloy, Mu metal, Co amorphous alloy, Fe amorphous alloy and Ni-Fe amorphous alloy (including at least one element selected from Mn, Cr, Co, Nb, V, Mo, Ta, W and Zr).

15. The method for manufacturing a magnetoresistant enameled wire according to claim 10, wherein the magnetoresistant material is at least one material selected from the group consisting of high permeability magnetically soft materials including:

- (1) Ni-Fe-Mo-based 4% Permalloys,
- (2) Ni-Cu-Zn-based magnetically soft ferrites,
- (3) Mn-Zn-based magnetically soft ferrites containing Fe_2O_3 , MnO, ZnO as main components and NiO, MgO, CuO, SiO_2 , CaO, V_2O_5 , TiO_2 , Nb_2O_5 , etc., as property-improving additives,
- (4) Ni-Zn-based magnetically soft ferrites,
- (5) Mg-Mn-Zn-based magnetically soft ferrites,
- (6) Mg-Cu-Zn-based magnetically soft ferrites,
- (7) Fe-Ti-N-based magnetically soft ferrites,

- (8) Fe-Cr-based magnetically soft ferrites (minor components: C, N, Si, Mn, Ni, P, S, Cr, Al, Mo and Ti),
- (9) Fe-Co-Ni-N-based magnetically soft ferrites,
- (10) Fe-Co-based magnetically soft ferrites,
- 5 (11) Fe-Al-Si-based magnetically soft alloy powders,
- (12) Fe-Al-based magnetically soft alloy powders,
- (13) Fe-Si-B-Cu-Nb-based magnetically soft alloy powders,
- (14) Fe-Br-B-Cu-based magnetically soft alloy powders,
- (15) Fe-B-M-N-R-based magnetically soft alloy powders (wherein M is an
10 element selected from Hf, Zr and Nb, N is Cu element, R is at least one element selected from Ti, V, Ta, Cr, Mn, Mo, W, Au, Ag, Zn, Ga and Ge),
- (16) Fe-based magnetically soft alloy powders $(\text{Fe}_{1-x}\text{M}_x)_{100-a-b-c-d}\text{Si}_a\text{Al}_b\text{B}_c\text{K}_d$
(wherein M is Co, Ni or a mixture thereof, K is at least one element selected from Nb, Mo, Zr, W, Ta, Hf, Ti, V, Cr, Mn, Y, Pd, Ru, Ge, C and P),
- 15 (17) Fe-based magnetically soft alloy powders (Fe is a base, either Co or Ni, and an additive is at least one element selected from the group consisting of Ti, Zr, Hf, V, Nb, Ta, Mo and W) ,
- (18) Fe-Zr-B-Ag-based magnetically soft alloy powders,
- (19) Fe-Hf-based magnetically soft alloy powders,
- 20 (20) Fe-Si-based, Fe-Si-Al-based, Fe-Ni-based magnetically soft alloy powders,
- (21) magnetically soft alloy powders composed of Fe-(at least one element selected from Ta, Hf, Zr, Nb, Mo, Al, Si, Ti, Cr and W)-(at least one element selected from C, N, O and B)-P,
- (22) magnetically soft powders having a composition consisting of iron oxide
25 (Fe_2O_3) , nickel oxide (NiO) , zinc oxide (ZnO) , copper oxide (CuO) and bismuth oxide (Bi_2O_3) ,

(23) magnetically soft powders having a composition consisting of Fe-Co-(at least one element selected from Sm, Er, Tm, Yb and Ho as rare earth metals)-(at least one element selected from C, N, O and B, elements for microcrystallization),

(24) Mg-Zn-based, Mn-Al-based, Co-Pt-based, Cu-Ni-Co-based, Cu-Zn-based,
5 Mn-based, Co-based, Li-based, Mg-based, Ni-based magnetically soft ferrite powders;
and

(25) magnetically soft composite oxides containing one or more compounds selected from Fe_2O_3 , Fe_3O_4 and CoFe_2O_4 as main components.

10 16. The method for manufacturing a magnetoresistant enameled wire according to claim 10, wherein the magnetoresistant material is present in an amount of 0.3~30% by weight in the varnish layer.

17. The method for manufacturing a magnetoresistant enameled wire according
15 to claim 10, wherein the coating is carried out by a roller coating.

18. The method for manufacturing a magnetoresistant enameled wire according to claim 10, wherein the softening is carried out at a temperature of 400~700°C.

20 19. A coil comprising the magnetoresistant enameled wire according to claim 1.

20. The method for manufacturing a magnetoresistant coil comprising winding the magnetoresistant enameled wire according to claim 1.

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